

REMARKS

Claim 2 is amended herein. Support is found, for example, at page 7, 2nd full paragraph, page 10 and the Examples. No new matter is presented.

I. Response to Claim Rejection under 35 U.S.C. § 103

Claims 2 and 4 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,355,768 (see Abstract and cols. 1- 6 and claims); or U.S. Patent 6,316,576 (see abstract, cols. 1- 4; and claims) each in view of U.S. Patent 6,376,641.

Applicants traverse the rejection for the reasons of record, which are incorporated herein by reference and based on the following.

Polycarbonate resins are applied to various optical materials. When optical materials have a large birefringence, various problems such as a fuzzy phenomenon in image formation at the point where light is transmitted to the inside of a material and reading errors of information occur. Therefore, polycarbonate resins with small birefringence have been developed.

Various materials with low birefringence have been developed. Such development aims at attaining a lower photoelastic constant. However, birefringence increases not only due to photoelasticity, but also due to molecular orientation during molding or due to film-stretching based on deformation hysteresis. Generally, an increase of birefringence due to deformation hysteresis becomes larger than that due to photoelasticity. Polycarbonate resins to be used as optical materials are initially subjected to molding or film-stretching.

An object of the present invention is to provide a polycarbonate copolymer which is capable of preventing the increase in birefringence generated during molding or film-stretching of the polycarbonate copolymer.

The present invention relates to a polycarbonate copolymer and a method of producing a the polycarbonate copolymer. The features of the present invention are recited in claims 1 to 4.

The polycarbonate copolymer of the present invention is produced by performing transesterification of a dihydroxy compound represented by the general formula (3) and a dihydroxy compound represented by the general formula (4) in a molar ratio of 30/70 to 70/30 with a carbonic acid diester and then performing polycondensation. The polycarbonate copolymer produced thus comprises 30 to 70 mol% of a structural unit represented by the general formula (1) and 70 to 30 mol% of structural unit represented by the general formula (2).

Each birefringence and photoelastic constant after film-molding and film-stretching of the polycarbonate copolymers obtained in Examples 1-6 and Comparative Examples 1-3 were measured.

As shown in Table 1, each range of claimed mol% exhibits criticality for lower birefringence after film-molding and film-stretching in each upper limit value and lower limit value.

On the other hand, each photoelastic constant measured in Table 1 has no relationship with birefringence.

Thus, the present invention can provide a polycarbonate copolymer which is capable of preventing an increase in birefringence generated during molding or film-stretching of the polycarbonate copolymer.

USP 6,355,768

The polycarbonate resin in USP '768 is obtained by polycondensation of structural units derived from an aromatic dihydroxy compound represented by the general formula (4), an aliphatic dihydroxy compound represented by the general formula (5) and a carbonic acid diester.

The aliphatic dihydroxy compound represented by the general formula (5) overlaps the dihydroxy compound represented by the general formula (4) of the present invention. However, the dihydroxy compound represented by the general formula (3) of the present invention is an ether compound while the aromatic dihydroxy compound represented by the general formula (4) in USP '768 is a non-ether compound. Thus, both are quite different.

The molar ratio ((3)/(4)) of the dihydroxy compound represented by the formula (3) to the dihydroxy compound of the formula (4) of the present invention is 30/70 to 70/30. The molar ratio (1)/(2) of structural unit (1) derived from the aromatic dihydroxy compound (4) to structural unit (2) derived from the aliphatic dihydroxy compound (5) of USP '768 is described at col. 3, lines 47 to 62. The range of molar ratio ((3)/(4)) of the present invention is different from the range of USP '768. USP '768 does not teach the criticality of the molar ratio ((3)/(4)) of the present invention.

The Examiner alleges that the formula (1) of USP '768 is identical to that of formula (1) recited in the present claims. However, the Examiner is not correct. Each R₁ and R₂ in the formula (1) of the present invention is a side chain. On the other hand, the ether group in the formula (1) is not a side chain, but a main chain attached to reaction residue of diols. Therefore, the polycarbonate copolymer of the present invention is also polyether copolymer. The polycarbonate of US '768 is not a polyether copolymer.

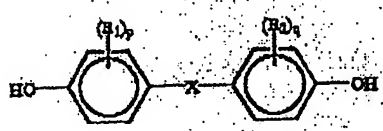
The object of USP '768 is to provide a polycarbonate resin which has a lower photoelastic constant (see col. 1, lines 57 to 62).

The object of the present invention is to provide a polycarbonate copolymer which is capable of preventing an increase in a factor of birefringence generated during molding or film-stretching. Thus, the object of the present invention is different from that of USP '768.

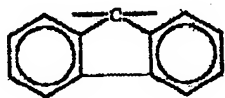
Therefore, the process for producing a polycarbonate copolymer of the present invention is different in starting material and molar ratio((3)/(4)) of two dihydroxy compounds from that of USP '768.

USP 6,316,576

USP '576 discloses a polycarbonate resin produced by the following dihydroxy compounds.



wherein x may be



The Examiner alleges that formula (1) of USP '576 is identical to formula (1) recited in the present claims.

The polycarbonate resin of USP '576 is quite different from the polycarbonate copolymer of the present invention and furthermore is not a polyether copolymer.

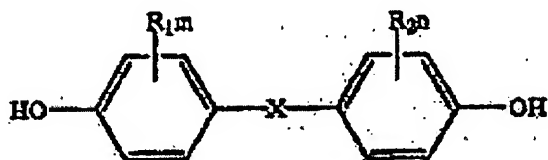
The aromatic dihydroxy compound represented by the formula (1) of USP '576 is a non-ether compound different from the ether compound represented by the formula (3) of the present invention.

Pentacyclopentadecanedimethanol of USP '576 is also different from the dihydroxy compound of general formula (4) of the present invention.

The object of USP '576 is to provide a polycarbonate resin having a lower photoelastic constant (see col. 1, lines 54 to 59) and is different from that of the present invention.

USP 6,376,641

USP '641 discloses an aromatic-aliphatic copolycarbonate produced from the following dihydroxy compounds.



The structural unit represented by the formula (1) of USP '641 is not a fluorene structure. The structural unit represented by the formula (1) of the present invention has a fluorene structure.

Further, the aromatic-aliphatic copolycarbonate of USP '641 is not a polyether copolymer.

Therefore, the copolycarbonate of USP '641 is quite different from that of the present invention.

The object of USP '641 is to provide an aromatic-aliphatic polycarbonate resin having a high Abbe's number and a lower photoelastic constant (col. 1, lines 55 to 60). The object of the present invention, as discussed above, is different from that of USP '576.

The cited references do not teach or suggest the presently claimed invention, whether taken alone or in combination.

As described above, the object of each reference is to provide a polycarbonate copolymer having lower photoelastic constant. In contrast, the object of the present invention is to provide a polycarbonate copolymer which is capable of preventing an increase in birefringence generated during molding or film-stretching of the polycarbonate copolymer. As shown in Table 1, photoelastic constant has no relationship with birefringence.

Thus, the object of the present invention is quite different from that of each of the cited references.

The present polycarbonate copolymer is also a polyether copolymer. However, the polycarbonate copolymer of each of the references is not a polyether copolymer.

Further, the specified molar ratio ((1)/(2)) or ((3)/(4)) of the present invention has criticality for lower birefringence in each upper limit and lower limit value. However, none of the cited references teaches such criticality.

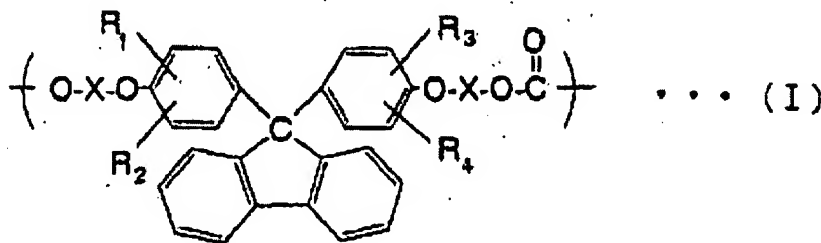
Therefore, even if the references were combined the present invention would not be achieved. Accordingly, Applicants respectfully request withdrawal of the §103 obviousness rejections.

II. Response to Claim rejection under 35 U.S.C. § 102/103 based on JP 10-101787

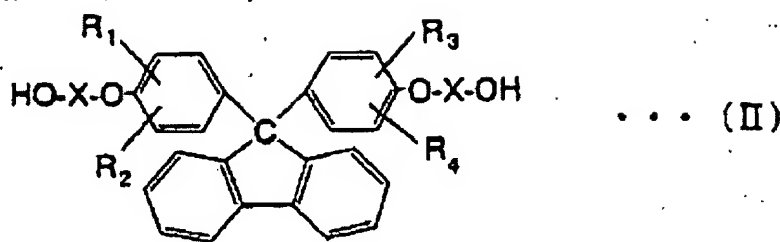
Claims 1-4 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over JP 10-101787 (note abstract and col. 7, page 5, second structure, paragraph [0024]).

Applicants traverse the rejection. A partial English translation of JP '787 is submitted herewith for the Examiner's convenience.

JP '787 discloses a polycarbonate having a repeating unit represented by the following formula (I) and a reduced viscosity (η_{sp}/C) of 0.2 dl/g or above.



The polycarbonate of JP '787 is produced by reacting a compound represented by the following general formula (II) with a carbonic ester-forming compound in the presence of a polymerization catalyst.



The polycarbonate of JP '787 is a homopolymer of repeating unit (I) and may be copolymerized with at least one compound other than the compound represented by the formula (II) in a proportion of less than 10 mol%. Examples of components other than the compound represented by the formula (II) are described in paragraphs [0024] , [0025] and [0026].

In contrast, in the present invention, the polycarbonate copolymer comprises 30/70 mol% of a structural unit represented by the formula (1) and 70/30 mol% of structural unit represented by the formula (2).

As described above, each range of the claimed mol% exhibits criticality for lower birefringence after molding and film-stretching in each upper limit and lower limit value.

At least one compound other than the compound represented by the formula (II) of JP '787 is applied in a proportion of less than 10 mol%. The proportion of other compound of JP '787 is outside the range of 30/70 to 70/30 mol% ((1)/(2)) or ((3)/(4)). For at least this reason, the present invention is not anticipated.

USP '787 describes at [0072] that the polycarbonate has a lower photoelastic constant than conventional polycarbonate resins. However, USP '787 does not teach a polycarbonate copolymer which is capable of preventing the increase in birefringence generated during molding or film-stretching.

The process for producing a polycarbonate copolymer and the polycarbonate copolymer of the present invention are different from those of USP '787 and there is no apparent reason to modify the process of JP '787 with a reasonable expectation of success in achieving the claimed invention. Thus, the present invention is not rendered obvious by JP '787.

Accordingly, Applicants respectfully request withdrawal of the § 102/103 rejection based on JP 10-101787.

III. Conclusion

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,

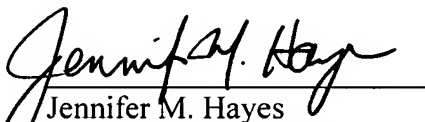
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